# PHOTOGRAPHIC DIFFICULTIES;

HOW TO

## SURMOUNT THEM:

# INSTANTANEOUS PICTURES;

## HOW TO OBTAIN THEM.

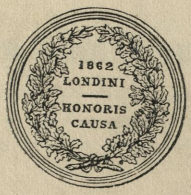

BY

**T. CADBY PONTING,**

COLLODION MANUFACTURER.

**CHEMIST TO THE QUEEN.**


AWARDED THE ONLY PRIZE MEDAL GIVEN FOR COLLODION AT THE INTERNATIONAL EXHIBITION OF 1862.

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"The best teachers are those who can seem to forget what they know full well; who work out results, which have become axioms in their minds, with all the interest of a beginner, and with footsteps no longer than his."—HELPS.

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# PRELIMINARY OBSERVATIONS.

ANYONE who, during the past eight years, has watched the progress of Collodion Photography, from its infancy to its present mature state, and has noted how it has gradually, but surely, superseded the Daguerreotype, the calotype, and wax paper processes, cannot but be struck with the gradually improved results that have been obtained. Little by little, with much labour of many minds, it has been advanced in skilful hands to such a degree of perfection and certainty, that further progress seems well nigh impossible. In fact, the high class pictures now produced, both in portraiture and landscapes, leave little to be desired, but colour, which there does not appear to be any probability of obtaining by any photographic process.

Steady growth of Collodion Photography.

To be a successful photographer, to be able to produce, at will, first-class works, requires an amount of knowledge and skill, only to be attained by untiring patience and perseverance. Photography, like all else that is good, rewards with its

Photographic success only to be acquired by labour.

highest honours, only the diligent and thoughtful worker; the youngest of the arts, it has had to deal with chemical effects previously but little observed, and to work with such new and recondite materials, that it is wonderful how so much has been effected.

Qualifications for assisting the novice.

The writer of these pages has been constantly engaged with photography, ever since its first introduction in 1841, originally as an amateur, and latterly as a manufacturer of collodion. In both capacities his experience has been considerable. In addition to being a worker, trying and experimenting much, he has necessarily been brought into contact with the experience of many others, the failures and disasters of the novice being naturally brought to the chemist for explanation; the object of the present little work is to gather up the knowledge thus practically acquired, and to set it down for the use and guidance of others; to state what, from the writer's experience, appear to be the most successful methods of manipulation; to point out the various sources of failure, and how to overcome the difficulties and disasters that beset the aspirant for photographic honours; for the success of the photographer must depend upon his ability to see whence his failure arises, and to apply a remedy. But let not the reader imagine that he will find all his failures and their remedies herein

set down; cases are continually occurring which puzzle and baffle the oldest and most accomplished hand. All that is attempted, is to give the results of the writer's experience hitherto.

The kind of information proposed to be given.

Into the general chemistry of photography, it is not proposed to enter, the excellent work of Mr. Hardwich ably supplying all needful information under this head; and the artistic treatment of photography has been well set forth by Mr. Lake Price. Those who require information on these subjects, cannot do better than supply themselves with the above-mentioned works, if they do not already possess them. Nor is it probable that any information herein contained will be either novel, or of any great importance to the practised hand; the object and aim being to furnish information to that large body of photographers who know little of chemistry, and are not desirous of making every article they use, but who supply themselves with most of the materials ready prepared. The practice of photography requires the expenditure of so much time and care, that those who wish to achieve success therein, will find that it is their best plan to avail themselves of the practical knowledge of skilled men, whose attention has been devoted to the manufacture of the several requisites, that they may have more time at their disposal for the higher branches of photography;

division of labour being as advantageous here as in most other pursuits.

Selection of Apparatus.

The selection of the necessary apparatus need not be entered upon. In every large town, respectable vendors of these things are to be found, who will be able to guide the beginner in his choice, or the catalogue of any respectable dealer will supply sufficient information for this purpose; but above all things avoid the cheap rubbish, got up to sell, by which the unwary are often taken in. In these remarks it is taken for granted, that the desire of the purchaser is to produce pictures equal to those obtained by practised hands; and he cannot hope to do this, unless he has good instruments and materials to work with. The inevitable trials and difficulties of the young photographer are quite enough, without his having to contend with the additional one of imperfect apparatus, &c., and, as the selection of the lens is of paramount importance, it should be strongly impressed upon him, that he cannot have one lens that will answer all purposes. A lens that is declared to be adapted for all purposes, is nothing but a delusion and a snare, and it would be a very false economy to invest in one; for be assured of this, that it cannot do so well as the lenses prepared for only one purpose, and it is not possible in the nature of things that it should.

# PART I.

# OF THE CHEMICALS.

# THE COLLODION.

To secure this essential photographic preparation of good and uniform quality, has been one of the most difficult tasks of modern chemistry, as those who have been long engaged in photographic manipulation, by this time, well know. It is now, for the most part, wisely left in the hands of those who have devoted special care and study to its preparation. That this has been no light task, the writer can abundantly testify—nine years of close and attentive pursuit of this object, with abundant practical experience, enable him now to say, that if at the outset he had been aware of the trials and difficulties that beset the manufacture, he would have left the task to other labourers. Fortunately, these difficulties were then unseen, and it is some satisfaction to feel that the labour has not been in vain; difficulties which once appeared insurmountable are a hindrance no longer, and there are now no obstacles which practised skill is not able to overcome.

Difficulties of Collodion manufacture.

If the fact be attentively considered, that gun-

cotton itself has been so recently discovered, and that its solution in alcoholic æther, named Collodion, was till lately so little known, and had scarcely any practical application, and that a very slight variation in the strength or proportions of the acids employed, the temperature, or the length of immersion of the cotton or other material, exercise so great an influence over the product, it will cease to excite our wonder, that so much that is empirical and theoretical has been broached upon this subject, almost inclining one to the belief that "an ounce of practice is worth a pound of theory." This anxiety to get at the theory of the process, has undoubtedly been its bane, the old Baconian system appearing to have been forgotten in the too eager pursuit of this object. The philosopher would have advised us first to get the *facts*, and then a *theory* if possible; and, if we were not prepared for this, to leave the theory alone till fuller knowledge should furnish sufficient data.

Pictures not taken on Collodion.

In the making of collodion it seems to have been overlooked that the picture is not taken on *collodion* at all, and therefore the name "a collodion picture" is really a misnomer. A little thought or a single experiment, will convince the operator that this is so. If a portion of collodion be taken, and sufficient water added to it, the whole

of the xyloidine will be separated, in the form of a gummy transparent mass, the collodion being decomposed, and it is this same xyloidine which is deposited on the surface of the glass when the collodionized plate is immersed in the watery solution of nitrate of silver, carrying with it a precipitate of iodide of silver. The same thing becomes apparent if a film of pure collodion, allowed to dry on the plate, without immersion in water, be compared with a similar film, which after being allowed to set only, has been subjected to the action of water. The difference between the dried collodion and the precipitated xyloidine is at once evident. The manufacture of collodion thus resolves itself into two parts, and the maker has to determine first what kind of film is best adapted to the photographer's use, and then how to produce it with certainty. The first is the more difficult task, from the fact of operators not being able to agree as to what are the essential desiderata.

Properties of the special Collodion made by the writer.

The writer claims to have discovered a method of preparing collodion, which has the valuable property of not only being the most sensitive preparation at present known, but at the same time of keeping for a lengthened period, without losing sensitiveness, while it improves in all other qualities. This fact of *keeping*, though so con-

trary to the experience of photographers working with other collodions, even cadmium collodion, has now been so well established, that it would be quite unnecessary to say anything about it here, were it is not for the fact that those who use it for the first time, naturally try it like other kinds, newly iodized, when the chances are, they will put it aside as useless. When first mixed it is of a deep sherry colour, and in that state it works slowly; but it gradually gets colourless, the period of this ripening being very uncertain. Sometimes a few days sufficing to bring it into good order, while at other times a month, or even more, is required. When arrived at this stage, it is in its best working condition, and remains so, unchanged. So well is this fact now understood, that the proprietor only supplies it in two solutions for exportation to distant countries, and even for this purpose he believes it would be better that it should be previously iodized.

# THE NITRATE OF SILVER BATH.

THE nitrate of silver bath undoubtedly is the photographer's greatest difficulty. Being unfortunately required in large quantities, and of an expensive material (its preservation in a good working condition is one of the grand desiderata of our art), too much care cannot be bestowed upon its preparation. Perfectly pure ingredients are indispensable; and carefully re-crystallized nitrate of silver, obtained from a reliable source, should alone be employed. Some samples of the *commercial* nitrate of silver are found to answer fairly, but, as a rule, it cannot be depended upon. A good and easy test of the purity of this article, is the suspension of a piece of litmus paper in the bottle containing the crystals. If, at the expiration of an hour, the paper remains unchanged, the absence of free nitric acid is indicated, and, along with that, it may be presumed, of the other impurities of the adhering mother liquor. Good re-crystallized will always stand this test, but it is very rare for the commercial to do so. *Fused* nitrate of silver the writer has always maintained to be a great mistake, because of the probability of

Pure ingredients indispensable.

Fused nitrate of silver not recommended.

its being made from the mother liquor, from which a crop or two of crystals have been taken, —the manufacturer thus being enabled to use up advantageously all his solution—and, therefore, instead of its being the purest kind, it is generally the very reverse, with the additional danger of its being further injured by the presence of *nitrite* of silver, from carelessly over-heating during fusion. This fact is now so fully recognized, that the employment of this form of the salt has almost ceased. The objections, of course, do not apply to the carefully fused sample, prepared under the watchful eye of the well-skilled manipulator, but, even then, it possesses no advantage over the re-crystallized.

Experiments with the bath.

So much difference of opinion prevails with regard to the bath being *neutral* or otherwise, that a set of very careful experiments were instituted to ascertain what were the real facts of the case, and in order to guard against error, the experiments were repeated three times, the first and second being a year apart. I would strongly advise photographers to make trial of the matter for themselves, for they would find in the knowledge and confidence thereby obtained, an ample compensation for the little trouble occasioned. There is, however, much uncertainty in these photographic experiments, unless great precaution be used to guard against

error—the danger of misreading or misinterpreting the results of our experiments, arising from the complexity of the subject with which we are dealing, and our proneness to overlook or disregard some seemingly trifling condition—a trifle which may turn out to be of the utmost importance. If photographers were more careful experimenters, there would not be such contradictory statements put forth, nor would such a mass of crude hypotheses pass unchallenged as are now met with among us.

The Collodion used.

Passing on to the experiment, I will detail, as clearly as I can, the method employed, and the results obtained in my hands. In the first place, it must be clearly understood that the collodion used, in this and all other experiments, was my own make, and at its ripe and colourless stage. With other collodions it is possible the results may be different.

Neutral bath, how made.

A neutral bath being necessary to start from, it was obtained by dissolving two ounces (avoirdupois weight) of re-crystallized nitrate of silver, in thirty ounces of distilled water, very carefully distilled at a low temperature over a gas flame. The solution was then divided into two equal portions, of fifteen ounces each, and placed in perfectly clean and new bottles, to one of which was added a small portion of oxide of silver, made by dissolving

a few grains of the same nitrate of silver in distilled water, and precipitating the oxide with liquor potassæ, P.L. (solution of caustic potash of pharmacopœia strength), ascertaining, first, that the liquor potassæ was perfectly caustic, by finding that it would not effervesce on the addition of a dilute acid. The oxide of silver was then thrown on a filter, and washed with distilled water. In the first experiment, in March, 1859, I mixed together five ounces of each of the two solutions of nitrate of silver, used the resulting bath, and obtained a clean and satisfactory picture. I then added one ounce more of the solution with the oxide, and on again taking a picture, found it foggy from the alkalinity of the bath, its neutral condition being restored by adding another ounce of the simple solution of nitrate of silver. On repeating the experiment, however, in March, 1860, a different result was obtained. The two solutions of nitrate of silver were made as before; but it being, at the time of preparation, very dull weather, quite unsuited to experiments of this kind, the oxide of silver remained on the filter several days, having three or four portions of distilled water poured over it each day; and in this way, I believe, all alkalinity, from the presence of liquor potassæ in the precipitate, was entirely got rid of. The solution of nitrate of silver saturated with this oxide, while still moist,

and allowed to stand over it several days, with frequent shaking, gave a clean picture free from fogging, when it was used without any admixture of the other solution. Thinking, from the discrepancy between this and the former experiment, and from the recorded experience of others, that some fallacy lurked in the experiment, a further additional trial was made, and a precisely similar result obtained. It would thus seem that the alkalinity, deemed to arise from the oxide of silver, is really due to the presence of a minute portion of the potash solution adhering to the oxide.

Experiments with the bath.

Having in this way obtained a perfectly neutral bath, which had neither acid nor alkaline reaction on test paper, further experiments were made to ascertain the effect of the addition of *acetate of soda* and *acetic acid* to the bath. For this purpose a pair of landscape lenses fitted to a binocular stereoscopic camera were used, the lenses being $1\frac{1}{2}$ inch diameter, five inches in focal length, and stopped down to three-eighths of an inch. This is a very convenient camera for such experiments, as it enables one easily to try the result of two different times of exposure under the same circumstances. The object was a lot of dingy old chimney stacks, roofs of houses, and a distant church tower, visible

from the operating room, giving near and distant objects, and brightly illuminated by a March sun; care being taken to select a day when the light was uniform, otherwise these comparative experiments would be of little value. A plate that had been immersed in the above neutral bath was exposed on one half of its surface three seconds, and on the other half six seconds, developed with the usual one grain to the ounce pyrogallic developer, with acetic acid. Ten drops of solution of acetate of soda* were added to the bath (of about 10 ounces), and a pair of negatives taken, giving precisely similar exposures to those of the first pair. Five drops of glacial acetic acid were now added to the same bath, and a third pair of negatives taken, keeping, of course, to the same exposures, each pair thus consisting of a negative taken in three seconds, and one taken in six seconds. The three negatives were printed together, on one piece of paper, the first negative having to be screened about one-fourth of the time, to prevent its being over printed. A descriptive account of the negatives is annexed, in a tabular form, for easy reference.

* Acetate of soda, 160 grains dissolved in one ounce of distilled water, to which is added sufficient glacial acetic acid to make it redden litmus paper, say ten drops.

## NEGATIVE No. 1.

A.

THREE SECONDS EXPOSURE.

A weak purplish sky; all the details of the illuminated parts of the picture are given, with some of the brighter portions of the shadows; no details in the deep shadows; prints dark and heavy.

Exposure too short.

B.

SIX SECONDS EXPOSURE.

This is a good negative of a purple red colour, full of half tone, and details of the dark parts well out; a little wanting in force, but furnishing a good print.

Neutral bath.

Exposure about right.

## NEGATIVE No. 2.

C.

THREE SECONDS EXPOSURE.

In this the effect of the acetate of soda is very apparent; sky intense; a much better negative than the one above; no details in the deep shadows; prints dark, but brighter than the one above.

Exposure too short.

D.

SIX SECONDS EXPOSURE.

A very intense negative; a black sky, which could not be printed through; details of the dark parts well out, but, being somewhat over developed, it prints with too strong a contrast between the lights and shadows.

Bath with addition of acetate of soda.

Exposure about right.

E. NEGATIVE No. 3. F.

THREE SECONDS EXPOSURE.

This is a good and vigorous negative; sky orange red; the details are all well out in the dark parts; half tones good; gives a good and forcible print, and with another second's exposure would have been beyond question the best of the lot; as it is, it is doubtful whether this or the B of No. 1 is the better. A little under exposed.

Bath with acetate of soda and acetic acid.

SIX SECONDS EXPOSURE.

This is a very intense negative, with orange sky, and the other portions of the picture of a red tinge; takes a long time to print; the sky weak from over exposure, and prints through, but the other parts vigorous and full of detail and half tone.

Over exposed.

Results of the experiments.

To sum up the results of these trials, it is clear that the addition of acetate of soda and acetic acid does not make the bath work slower. In fact, if these experiments may be relied upon, it is shown that the action of the bath is thereby accelerated, for the pair of negatives No. 3, are very much better than No. 1 pair, and there would be considerable difference of opinion among photographers as to whether the negatives

B or E were the better, though the latter was exposed only half the time of the former. Although I had, for years, employed and recommended to others this method of making the bath, I was not at all prepared for this result. For myself, I had long been abundantly satisfied, as the result both of my own experience and that of others, that this preparation furnishes the operator with an organic matter, not injurious to the bath, which gives him a controlling power over it, so as to enable him to increase or diminish the intensity of his negatives; and, in addition to this, there is plentiful proof that the bath is, by its use, preserved in good working order for a longer time than by any other method.

Acetate of soda, its action.

This accelerating action of acetate of soda with acetic acid (for they should always be used together, as these experiments demonstrate), being quite unexpected, some experimental negatives taken a year ago, were examined, to see if they would bear out this statement; and, on submitting them to careful inspection, there could be no doubt of the fact. The trials were made at the time, to demonstrate the increase of intensity obtained, without adding to the exposure, and as they proved that no further search was made, and as no prints were taken from them, the difference was not so manifest. In order still further to be satisfied that

the result in question was not due to an accidental increase of light in the favoured negative, a further set of experiments was made, with a fresh sample of collodion about a month old (the previous one being about nine or ten months old), commencing with an entirely new neutral bath, and, altering the order of the previous experiment, acetic acid alone was added for the second trial, the third attempt being with both acetic acid and acetate of soda. The result was quite confirmatory of the first set of experiments. The time of exposure was increased to four and eight seconds respectively. The four seconds exposure was abundantly long enough for the first and third plate; the one with acetic acid alone was much slower than the other two; but the third negative, with acetic acid and acetate of soda, was again, unmistakably the best of the lot. Of the negatives with eight seconds exposure, the first, with neutral bath, is so much over-exposed as to be useless; the second, with acetic acid alone, is about right; the third, with acetate of soda and acetic acid, is considerably overdone, but gives a tolerably good print notwithstanding. The slight difference between this negative and the corresponding one of the former experiment, is probably due to the fresh sample of collodion, but is confirmatory of previous experience, which showed that the operator might with this bath, much increase his

Further experiments.

exposure to get out any very dark portions of the picture, with greater impunity than when using a neutral, or nearly neutral, bath.

Chemical change produced by acetate of soda.

The chemical change produced in a solution of nitrate of silver by the addition of acetate of soda, is a double decomposition, acetate of silver and nitrate of soda being formed. The former being precipitated in small flakes, which require some little time for solution, with shaking or stirring. No doubt acetate of silver alone would produce the desired effect, but it probably dissolves better when formed in the solution, and the small quantity of nitrate of soda appears to have no deleterious effect.

Substitutes free acetic acid for free nitric acid.

There is also a further action when nitric acid is either present in the original nitrate of silver, or is afterwards set free in the bath, by the use of coloured collodion containing free iodine, which, uniting with the silver, liberates the nitric acid, without supplying a base for it to unite with. Free nitric acid being very injurious in a negative bath, except in the case of collodions containing *bromides*, the acetate of silver has the advantage of correcting this nitric acid, for, since it has a greater affinity for the silver than the acetic acid, they change places, and the acetate of silver is converted into nitrate of silver, setting the acetic acid free.

The form for making the bath would stand thus,

Formula for bath.

Pure re-crystallized nitrate of silver 1 oz. (avoirdupois)
Pure distilled water ... ... 15 oz.

Dissolve and add

Solution of acetate of soda (see page 16) 15 drops.
Glacial acetic acid ... ... ... 7 drops.

Some time (perhaps an hour) is required for the solution of the acetate of silver formed.*

For landscapes.

For portraiture.

For picture copying.

These are the proportions best adapted to landscapes or out-of-door work; but for portraiture in glass rooms, only half the above quantity of acetate of soda and acetic acid should be used, unless very intense negatives are desired, when more can be added. For picture copying it is often desirable to obtain great intensity, and in this case sufficient solution of acetate of soda should be added to *saturate* the bath with acetate of silver. The addition of iodide of potassium, alcohol, or ether, is in my opinion

Iodide, ether or alcohol, a pernicious addition.

* Many operators have found considerable difficulty in making this bath. Extended experience has shown, that, as a general rule, it requires to stand several days before it gets into good working order.

worse than useless; the more foreign matters are introduced into the bath, the more liable it is to change and decomposition.

One Collodion only used.

As I have never tried any of the negative collodions made in the ordinary way, with this bath, I am unable to speak of their behaviour, but it is very probable that any collodion which rapidly decomposes and sets the iodine free, would work very slowly with such a bath as this.

How to preserve the bath.

Having considered the method of making the bath, it remains to show how best to keep it. In the first place there can be no question that a *glass* bath is the best to use, next to that a *porcelain* one. Gutta-percha, or *so-called* gutta-percha, should not be thought of. There are still some persons, indeed, to be found, who affirm that they have kept their baths in gutta-percha for years, without finding the bath injured thereby. But it is probable that these photographers, when the bath does get out of order, attribute its change to something else, whereas, if the cause were properly investigated, it would turn out that the baths had been spoiled by gutta-percha. Having frequently to evaporate down small quantities of old bath in a porcelain capsule, over a gas flame, in order to get at the solid contents, towards the conclusion of the process, when the product gets nearly dry, I have found that baths which have been kept for some

Gutta-percha baths to be avoided.

time in gutta-percha vessels, smell as if gutta-percha were burning in the room, thus furnishing unmistakable evidence that the bath which, after a time, gets charged with alcohol and ether, becomes a solvent of the gutta-percha. A very convenient arrangement for the operating room is a glass bath in a wooden case and wooden cover, leaving a space of about an inch above the bath, for the dipper. The bath keeps very well in this, which protects it from dust, yet still allows a small evaporation of the ether and alcohol absorbed from the collodion. A bath very much used, soon deteriorates, in consequence of the silver being abstracted from it, as well as from the ether and alcohol which it retains, often in sufficient quantity to produce a film on the surface, and the plate, passing through this film, acquires a streaked appearance in the direction of the dip. The obvious remedy for this defect, is to put it aside for a time, till the ether has evaporated; or it may be driven off more quickly by the application of heat, either by placing it in the sun, or immersing the bottle in warm water, with the stopper removed. To supply the loss of silver, it is only necessary to fill up with a forty-grain solution of nitrate of silver, as required. When a bath, after continued use, gets out of order, very seldom can it be effectually "doctored." If a few drops of glacial acetic acid do not put it right,

A good plan for operating room.

Bath injured by much use, how remedied.

better discard it at once, and make a new one, and save yourself much vexation and annoyance.

Water-tight baths, their difficulties.

In the matter of water-tight baths there is still very considerable difficulty. Glass covers would undoubtedly be the best, but it is exceedingly difficult to secure the cover quite tight. A cushion of pure india-rubber for a cover seems the only effectual contrivance, but, as india-rubber dissolves in pure ether, there are doubts about its action on the bath, when charged with ether. Probably the very dilute state in which it is in the bath, would prevent its solvent action on the cover, and in practice it is found to answer; but more information is wanted on this point. The introduction of silver wire dippers is likely to neutralize any free acid the bath might contain, by slow solution therein; and gutta-percha dippers, even when pure, must have the same effect as a gutta-percha bath. There is nothing so good as a glass dipper. The risk of fracture is great in travelling, but provision should be made for this casuality by carrying one or two extra ones.

Bath, how to clean.

The bath requires occasional cleaning, and no better method can be adopted than the use of a piece of flannel, linen, or cotton, fastened to the end of a piece of cane or wire. The inside surface of the bath should be rubbed with it previously wetted, and then thoroughly washed with a

plentiful supply of water, allowed to drain, and rinsed out with distilled water. The use of nitric acid and cyanide of potassium for the purpose of cleaning the bath is attended with so much danger to the bath solution, that it is unwise to resort to it.

# DEVELOPMENT.

THIS part of the process requires considerable care and experience, more so perhaps than any other. How far to carry the development, and when to stop it, is a knowledge to be acquired only by practice and observation. It is also requisite for the operator to be acquainted with the printing capabilities of negatives, before he can efficiently deal with this important branch of the photographic art. Operators accustomed only to develope positives pictures, are almost sure to fail, from the fear of over-developing their negative, thinking they ought to be able to see the picture on the surface of the glass, in a similar manner to a positive; whereas the best negatives are those which do not present such an appearance, the very deep shadows alone appearing transparent.

Some experience necessary

Difference between positive and negative development.

The methods of developing are various. Some operators hold the plate in the hand, and pour the developing fluid on and off the plate. This has the advantage of allowing the progress of the development to be readily seen; but it requires

Methods of developing.

great care to get the fluid rapidly and evenly over the plate, and, moreover, there is the annoyance of producing photographic stains on the fingers.*

Plan for operating room.

The plan best adapted for the operating room, is undoubtedly to use a levelling stand placed in a tray larger than the plate, to catch the overflow of the liquid, the operator being thus enabled to move the developing fluid about without touching the plate, by moving the tray instead; and, when the plate is level, there is very little difficulty in getting the fluid rapidly over. If the levelling stand be placed before the window, the negative can be examined without removal, by looking up through it, when the termination of the development approaches; the fluid can be poured off into the glass, the negative examined, and, if not sufficiently developed, replaced on the stand, and the fluid poured on again.

Quantity of developing fluid requisite.

There is one secret of success which it may not be amiss, in this place, to remind the reader of, and that is, *first*, to have a sufficient quantity of developing fluid to cover the plate well, and *secondly*, to have a glass by which the liquid can be poured on with ease and rapidity. Suitable

* If *gloves* are worn as a protection, they should be invariably taken off before proceeding to *fix* the picture, or stains are sure to be produced on the next plate by the adhering hypo-sulphite.

ones can be purchased of the dealers. If too *much* fluid be employed, there is considerable overflow; the nitrate of silver bath adhering to the film, is necessarily much diluted, and a weak negative is the result; on the other hand, if too *little* be used, it cannot be got over the plate sufficiently quickly in one continuous flow, and lines and stains are the consequence.

Mode for out-door work.

This method can rarely be used for field work, except with large tents or carriages. In other cases the use of a tray of gutta-percha, porcelain, or glass, is the better plan, the tray being of a size nearly to fit the glass plate, only allowing sufficient room to enable the operator to lift it out. The tray containing the plate to be developed should be supported by the left hand, and the developing fluid poured over by the right; the fluid can in this way be easily made to flow over the plate and be as easily kept in motion. The only disadvantage which this method presents, is the necessity of washing the tray after each operation; but a small quantity of water and a stiff painter's brush readily effect this. For the developing boxes, where the operator has to watch the development through yellow glass, a white tray becomes necessary, the progress being so much better seen against the white.

Developer for portraits and landscapes in general.

The best developer for portraiture and for land-

scapes generally, is undoubtedly the mixture of pyrogallic and acetic acids, in something like the following proportions :—

| | | | |
|---|---|---|---|
| Pyrogallic acid | ... | ... | 8 grains |
| Glacial acetic acid | ... | ... | 1 drachm |
| Water | ... | ... | 8 ounces. |

A drachm of spirit of wine may be added to make it flow readily over the plate. This developer generally produces a red colour in the high lights, and gives a good-toned negative.

Developer for instantaneous pictures

For taking *instantaneous* pictures, and for quick portraiture, a developer made with protosulphate of iron will be found of service, though undoubtedly the negative loses much in force; and, where strong solutions are employed, considerable dexterity is required to get the developer quickly over the plate, the rapidity of action being such that lines are formed wherever the flow of the developer is stayed. This, however, is a matter of manipulation which presents no difficulty to the practised hand.

The formula is as follows :—

| | | |
|---|---|---|
| Protosulphate of iron, from 40 grs. to 120 grs. | | |
| Glacial acetic acid | ... | 1 drachm |
| Water ... ... | ... | 8 ounces |
| Spirit of wine, if requisite. | | |

The strength of this developer may be varied at pleasure, the weaker solution being more easy to manage, and the stronger enabling the operator to give a shorter exposure. It should be observed that this developer gives the best results when newly made.

For intensity and long exposures.

Where great intensity is desired, or where some dark portions of the picture require so long an exposure to bring out the details as to solarize the high lights, then the pyrogallic developer, with citric acid, will be found the best, particularly in the case of landscapes where the sky from over exposure gets weak and thin; also for picture copying it will be found by far the best. The following is the formula:—

For picture copying.

| | | | |
|---|---|---|---|
| Pyrogallic acid | ... | ... | 8 grains |
| Citric acid | ... | ... | 4 grains |
| Water | ... | ... | 8 ounces |

Spirit of wine, if necessary, 1 or 2 drachms

This developer acts very slowly, and operators accustomed only to use the first two formulæ would be inclined to think the picture underexposed, and to discontinue further development. A few trials will soon show the relative value of these three developers. The first is, perhaps, the most generally useful, but where a quick exposure is desired, the second should be employed, and the

third when the time of exposure is a matter of minor importance.

The addition of nitrate of silver rarely required.

The addition of nitrate of silver to the developer is very rarely required, since, if the plate has been but a short time out of the bath, there is always a sufficient amount of silver for its proper development, without any further supply, the tendency of an *excess* of nitrate of silver being to produce a deposit all over the plate, and so to fog the shadows. It is much better to continue the development for a longer time with the same fluid, and many experienced operators fail in getting an intense negative, from not prolonging the development. Especially is this the case in cold weather, when the action is very slow; though no amount of development will serve to produce anything but a weak negative from an *over-exposed* plate. When the action of light upon the sensitive film has been feeble, and therefore the exposure very long, as in the case of copying pictures with lenses of long focus, or of working in dull weather in winter, it will be necessary to re-dip the plate in the nitrate of silver bath, for an instant, before developing, or to add nitrate of silver to the developer. The former is the better plan wherever it can be adopted, as it facilitates the flow of the fluid over the surface, which is very difficult to manage

Time of development.

Plate to be re-dipped after long exposure.

on a plate that has been long drained and has become dry on the surface. Occasionally very considerable difficulty is experienced in getting the developing fluid to flow evenly over the surface of the film, which repels the liquid as horn or grease would. This frequently arises from some *impurity* in the *bath*, an old bath often causing it, when a new one will not. With *new collodion* also there is a greater tendency to this failure. The best way of dealing with this state of things is largely to increase the quantity of *spirit of wine* in the developer, even to the extent of one-fourth part of spirit, if less will not do. In some cases an increased supply of *acetic acid* in the developer will furnish a remedy, and sometimes merely re-dipping the plate in the bath before development will be found to answer.

Developer flows with difficulty.

To the novice it may be desirable to state, that in judging of the intensity of a negative during development, it will be necessary to make considerable allowance for the loss of the iodide of silver in fixing, the presence of this thick film of iodide making the dark portions of the negative appear much denser than they really are.

Intensity altered by fixing.

Since the foregoing remarks were written, I have been favoured with the practical experience of a professional photographer of this city of Bristol, Mr. W. H. Barton, who is a careful

Development in winter.

experimenter, on the methods of development which he has found best during the dark and dull days of winter. Professional operators who are compelled to take pictures in dull weather, will deem any information on this point, of especial value, as affording help in one of the chief difficulties they have to contend with.

The result of this gentleman's experiments is, that with the bright light of summer, very little difference can be detected either in point of time, or quality of negative, between the pyrogallic and iron developers; but that during the low light of winter, the iron developer gives a very manifest advantage in the time of exposure. His plan of operation is, first to use the iron developer of moderate strength (ten grains of protosulphate of iron to the ounce), to bring out the details of the picture; this is washed off, and a weak solution of pyrogallic acid, with a little silver is then employed to strengthen the negative, (say half a grain of pyrogallic acid to the ounce, with four drops of a thirty grain solution of nitrate of silver). This method is also serviceable in the evening light of summer. This experience of the difference between the two developers, depending upon the amount of light present, corresponds so entirely with my own, as well as with that of many other operators, that

it seems to decide between the divergent opinions that have been expressed upon this point.

The same operator has also found that by *warming* both the bath and developer during the cold weather, the time of exposure is shortened.

# FIXING.

Strength of the solution.

THIS is best done by the use of hyposulphite of soda, say one pound of hyposulphite dissolved in a quart of water; solutions of greater density, though they act more quickly, are apt to carry away any portions of the film that may happen to be loose. Cyanide of potassium is, for many reasons, better avoided; if too strong a solution be used, the negative is weakened, while its poisonous nature renders it a very undesirable companion.

Action explained.

It may be needful to explain that the peculiar action of these fixing preparations consists in their being able to dissolve out that portion only of the iodide of silver unacted upon by light. This is known to be done by the disappearance of the creamy-looking iodide, and is best ascertained by examination of the back of the plate.

Requires to be well washed.

A plentiful supply of water is now required, either poured from a jug, or issuing from a tap, in order to remove every trace of the fixing solution, which, if allowed to remain in the

picture, in however small a quantity, would eventually destroy it. Care must be taken in washing, that a *gentle stream only* be used, or the film will be washed off the plate. When the negative is thoroughly washed, the plate should be reared up on edge in a clean place (collodion side inwards to prevent injury from anything falling upon it), and allowed to dry; or it may be dried by a fire. The plate is then ready for varnishing.

# VARNISHING.

Varnishes, their difference.

WHEN the negative is wanted to print a great many copies, varnish which requires the plate to be warmed is the best to employ, on account of its superior hardness. Though a little more troublesome to apply, the result is far better, as it gives a surface that will bear the wear and tear of printing with greater impunity than when amber varnish or other kinds that do not require heat are employed.

The writer has lately succeeded in making a varnish which answers the desired end admirably, furnishing a very hard and smooth surface, not easily injured. He has named it "*Bristol hard Varnish.*"

How to apply.

The method of applying all heat varnishes is simple enough. Care being taken that the film is perfectly dry, the plate, if small, is held by one corner, or if large, by a screw plate-holder, and is warmed evenly all over to a temperature that the back of the hand will readily bear; the plate

being held level, the varnish is then poured on and off in the same way as the collodion, and the plate warmed again, care being taken that it is kept in the same position until dry, for if the inclination of the plate be greatly altered during drying, the varnish will set in wavy lines. The operation is best performed before a good kitchen fire. There may be some little difficulty experienced at first, about obtaining the right temperature, for, if the plate be too hot, the varnish will set unevenly and in blisters; and, if any portion be too cold, the varnish on that part dries opaque. Where this occurs, it may be re-varnished, though the second varnishing is much more troublesome than the first. A little experience, however, will enable the operator to secure a good result the first time. Varnishing with amber or crystal varnish is much more easily managed, as it is used cold. The same precaution about dryness of the film and the maintaining the same position of the plate during setting, are all that is required; but the varnish is much more easily scratched and injured than the heat-applied ones.

Plate must be kept in same position to prevent waves.

Amber varnish.

# PART II.

# OF THE MANIPULATIONS.

## TO CLEAN THE PLATE.

THE first step in photography is to obtain a clean surface on the glass plate for the reception of the collodion, for, unless this essential preliminary be secured, all the after operations are so much time and material wasted. It will be our business now to point out the best method of doing this, and to furnish the needful precautions against failure.

A clean plate absolutely necessary.

The operator must be provided with

1st. An abundant supply of clean water,

2nd. A linen cloth and chamois leather, both perfectly clean,

Materials necessary.

3rd. Some dilute nitric acid—say nitric acid one part, water five parts. This, while it chemically cleans the plate, is not of sufficient strength to stain the fingers yellow.

The linen cloth must be washed in two or three lots of clean water, without soap or soda. The chamois leather has to be freed from the oil it contains, by soaking for an hour in a strong solution of washing soda (say one pound of soda

Cloths and leathers, how washed.

to a quart of water), then thoroughly rinsed in several lots of clean water and dried. If these articles be not entirely freed from soap and soda, it will be impossible to obtain a chemically clean plate; great care should be taken to keep them clean, by providing a box or drawer to put them in. If allowed to lie about the operating room, they would be liable to be used for anything. Smudges, smears, and other marks on the glass, may be traced to the cloths not having been carefully preserved from contact with soiled fingers, or other sources of contamination.

Should be carefully kept clean.

How to set to work.

The operator being provided with these materials in the condition indicated, the process of plate cleaning is a very simple affair. A little of the dilute nitric acid being poured into any convenient vessel, such as a gallipot or glass, a cork is taken and dipped into the acid, with which the plate is carefully rubbed all over on both sides, using the round part of the cork; then a stream of water is allowed to flow over the plate, either from a tap or jug, until it flows evenly without a greasy appearance. The plate being held by one corner for a few seconds to drain, is placed in the clean cloth, which should be large enough to enable the operator to hold the plate without its coming into contact with the fingers, and, after it has been wiped dry, it should

be transferred, for its final polishing, to the leather, which is also required to be sufficiently large to prevent the fingers touching the plate. It may now be fixed on a plate-holder, or, if small enough, can be held by the finger and thumb at one corner. A flat camel-hair brush should be passed lightly over, to remove the few remaining dust particles, when it is ready for the collodion.

A box of plates may thus be prepared for future use, taking the precaution to give a final dusting before using them. Patent plate should alone be used, as it is difficult to clean any of the other sorts, from their not having a polished surface, and no other kind possesses the requisite flatness to stand at all times the pressure of the printing frame.

Kind of glass to be used.

Plates that have been much used are very difficult to get clean, especially if the film has dried and remained on for some time. Frequently with such plates the old negative seems to have left an indelible impression upon the glass which no polishing can remove, and which developes along with any new picture taken thereon. Most photographers of any experience must have met with one or two cases of this kind.

Old plates difficult to clean.

Another difficulty sometimes occurs with old plates, when placed, a lot together, in water to

soak for any length of time, the water seeming to have some peculiar action upon the glass, rendering it quite impossible to get the plates clean again. Most likely this is due to the presence of lime in some form or other in the water; however that may be, the fact remains.

Precautions in packing.

Before proceeding upon a photographic tour some years ago, the writer cleaned a lot of plates, and carefully packed them in dozens, with pieces of clean blotting paper between each, the paper being somewhat smaller than the plates. On developing the pictures, the mark of the paper appeared, so that he was compelled to clean all the plates again before he could use them.

Insufficient polishing.

A lot of patent plates, received a short time since from Chance's, produced smears and smudges which could not be accounted for, until, on careful examination, they showed that they had been imperfectly polished upon those spots, which, though visible only when viewed under certain aspects, were so apparent when the photograph was taken, as completely to spoil the picture.

Grinding the edges.

One more matter in connection with the plates, and I have done. The edges should be ground to give the collodion a *bite*, and prevent its tearing off in the process of washing. Very little trouble is necessary for this purpose, as it is only the cutting edge of the glass that requires to be destroyed.

Rubbing the edge some half-a-dozen times over a wet paving stone is quite sufficient; the same object may be effected with a file, or even with sand paper.

## COATING THE PLATE.

To produce a smooth and even film on the plate, is a matter requiring some dexterity. The best method of doing this, it will be necessary now to detail. Small plates may be held by the finger and thumb at one corner, of course taking care to prevent the collodion from touching the fingers. Large plates are best held by a pneumatic plate-holder. Some very secure holders of this description are now to be obtained of the respectable dealers. A tall bottle with a wide lip should be used for the collodion; small particles fall to the bottom of the bottle, and a wide opening is required to catch the superfluous collodion as it is poured off the plate.

How to hold the plate.

Bottle for Collodion.

The plate being held in the left hand, and examined to see that there are no dust particles remaining on its surface, the collodion is to be poured on the centre very steadily, to prevent air bubbles, till there is a pool about half the size of the plate. Each corner must then be lowered in succession, to spread the collodion,

Pouring on the Collodion.

Quantity required.

leaving to the last, the corner nearest to the right hand, in which the collodion bottle is still held to receive the overflow, which is allowed to run off at this corner, the opposite corner being at the same time *slowly* elevated, giving the plate a slight motion sideways to prevent lines. It is then held over the bottle until it ceases to drop, and, when set, which at a temperature of 60° usually requires about a minute from the time of ceasing to drop, it is transferred to the dipper, and plunged with a steady continuous motion into the nitrate of silver bath, where it should be allowed to remain for about two minutes, or until the bath runs freely over the surface of the film without a greasy appearance. This may be hastened by moving the plate in and out a few times. The plate is now ready for the camera, and as little delay as possible should take place before it is exposed and developed, a plate kept about long, being very likely to be injured by dust and stains, while the draining away of the silver solution, renders the negative thin and feeble.

Time of setting.

Time in the nitrate silver bath.

Delay in exposure undesirable.

Perhaps the greatest difficulty to a novice is the estimation of the quantity of collodion necessary to cover the plate well. If too small a portion be used, of course it cannot be got over the plate, and with too large a supply it

Difficulties to a beginner.

overflows and is wasted. A few careful trials will soon give the knowledge requisite. Above all things avoid *haste;* with a good collodion there is abundance of time—say two minutes from the commencement of the operation to its immersion in the bath—to enable the operator to proceed with deliberate carefulness.

Take your time.

Another great difficulty, even to old hands, is to determine the time to allow the film for *setting*, more especially when collodions from various makers are used. It will be desirable, therefore, to point out the appearance of the film when either too much or too little time has been allowed for this purpose. As the special collodion to which, it must be distinctly understood, all the remarks in these pages have reference, contains its full proportion of alcohol, (*i.e.* one half part,) ample time should be allowed for setting. At a moderate temperature in summer, about a minute is required from the time of its ceasing to drop, or say two minutes from the commencement; this not only allows abundance of time to cover the plate without haste, but likewise ensures a much smoother film. If immersed too early, the film is very rotten, and is with great difficulty kept on the plate; crapy lines make their appearance, and sometimes some peculiar wavy lines are formed in the body of the film, especially at

Ample time to be given or setting.

Too quick immersion.

that part of the plate where the collodion was poured off, the iodide of silver having a tendency to collect together in these lines when the collodion is in a sufficiently fluid state to permit their motion. On the other hand, if too long a time has been allowed, the surface gets dry and horny, especially at the top of the plate, which becomes very thin and almost transparent, the bath being unable to penetrate it.

Too long before immersion.

# EXPOSURE IN THE CAMERA.

But little information can be given.

It is impossible that any positive directions can be given under this head, so much depending upon the lens, the light, and the condition of the bath; and yet the perfection of a photograph depends mainly upon its being exposed a proper time. No prolongation of development will serve to make an under-exposed picture equal to the one exposed a proper time, and an over-exposed one will always remain weak and flat do what one may to it.

In furnishing some idea of the time usually required for exposure in the camera, as stereoscopic landscape lenses are most frequently in use by amateurs, it may be as well to give the time required by one of five-inch focus, with a quarter-inch stop. Under favourable circumstances with a good light, from two to five seconds, would be the time for objects at a middle distance, say trees and houses, &c.; near objects of course require a longer time, and distant ones less.

Instantaneous pictures may be taken with such a lens, with either a half-inch or five-eighth stop; but, in this case, it is necessary not only that there shall be brilliant sunshine, but that there shall be no very near objects in the picture. Pictures of sunsets, with the sun shining into the camera, may be taken instantaneously, under very favourable circumstances, with the quarter-inch stop.

Instantaneous pictures, some of the requisites.

A very excellent method of trying the right time of exposure, is to give different periods of exposure to two or more portions of the plate. This, which will really furnish the learner with more information than can possibly be conveyed by other means, is readily done as follows. Placing the camera on its side, pull out the slide half way, and expose for a short time—say, for example, four seconds; replace the cap of the lens, and then pull out the slide to its whole extent, and expose for another four seconds. Thus, on the same plate, the first portion will get eight seconds exposure, while the latter will have but four; and of course, the plate may be in the same way divided into three or four parts, with as many different exposures. The object should be a pretty even one, say the front of a house, with sky, so that by placing the camera on its side, each separate portion of the negative may have both sky and a part of the building. When this is developed and

Experiment for trying the right time of exposure.

afterwards examined, no great difficulty will be experienced in determining which is the best time of exposure. With a binocular camera this experiment is still more easy, as each half of the plate can be exposed for a different period, and as the whole of the picture will be on each, it can perhaps be more easily seen which is the best. If any difficulty occur in deciding this point, a print should be taken to settle the matter. The time spent in a few experiments of this character will be well bestowed, and is very frequently required even by the oldest hands.

Over-exposure a common failure.

It is astonishing how apt we all are to *over-expose* our pictures. We seem to reason that, if five seconds will give a good picture, ten seconds will give a better one; and it is only by constant and repeated failure that we get this notion driven out of us. There can be no doubt the most common source of failure is from over-exposure, more especially with those who take up this collodion for the first time. A negative that has been much over-exposed, presents a very weak thin appearance, and even though it may be far from fogging, no amount of development will make it intense. An under-exposed negative, on the contrary, is very intense in the high lights, with little or no detail in the shadows. A rightly-timed negative has a

Appearance of over-exposed and under-exposed pictures.

pecular *bloom* over it; the high lights, such as the sky, are red, the picture scarcely showing on the surface; but, on examination, by looking through, all the details are well out, the deepest shadows alone being transparent. Rightly-timed exposure.

With portrait lenses in glass rooms, it is impossible to give the time with any approach to accuracy, as both lenses and rooms vary so much. The operator should try for himself, by focussing some printed matter, such as a newspaper fastened against a wall, and then by giving three or four different times of exposure on the same plate, in the way previously explained, he will be able to ascertain the proper time of exposure, though much less time will be required at similar distances to take the white paper, than a sitter with dark drapery. Time with portrait lenses in glass rooms.

The novice should also bear in mind that the nearer the camera is to the object, the longer will be the time required to take the picture, from the fact of the focus being lengthened, and the light of course lessened. It follows that a distant object will require a considerably shorter exposure. Length of focus to be considered.

In very hot weather, with the camera standing in the sun, the plate dries very rapidly, causing the nitrate of silver to crystallize and dissolve out the iodide of silver in small spots. To prevent this, keep the inside of the camera filled with a Rapid drying of the plate in hot weather, how remedied.

Also for long exposures in copying pictures.

moist atmosphere, by placing therein a wet sponge or cloth. In *picture copying*, where the plate has to be exposed for a lengthened period, this plan of introducing a wet substance becomes absolutely necessary, to prevent the plate drying.

Camera to be kept constantly closed.

The camera should be carefully kept closed when not in use. Never, by any chance, leave the focussing screen out, or it soon gets filled with dust, which settles on the moist surface of the plate during exposure, and prevents the light acting on the film, causing transparent spots, frequently so annoying and troublesome. When these occur, the inside of the camera should be carefully wiped out with a damp cloth or sponge. In picture copying this is more especially necessary, as the long exposure gives time for the dust to settle on the plate.

# PART III.

## FAILURES, THEIR CAUSES AND REMEDIES.

## THIN WEAK PICTURES WANTING INTENSITY.

From over-exposure.

THE most frequent source of this failure, especially with beginners, is from *over-exposure*. A plate may be so over-exposed as scarcely to shew any trace of a picture; but it is seldom that the over-action of light is carried to so great an excess as this. More frequently there is a trace of a picture, more or less faint, of a pale yellow or orange colour, if developed with pyrogallic and acetic acids, but, where the protosulphate of iron developer is used, the negative assumes a thin grey colour. To ascertain whether the failure is from this cause, the experiment described at page 53 should be tried.

From insufficient development.

Sometimes *insufficient* development is the cause, more especially in cold weather and with a feeble light. A silver bath much used

gets reduced in strength, and will give only faint pictures. The bath should be kept up to its proper strength, by supplying the waste with a solution of nitrate of silver of 40 grains to the ounce.

From a weak bath.

From free nitric acid.

If *free nitric acid* be present in the bath, a strong negative cannot be obtained therefrom, when collodion that does not contain a *bromide* is used. The constant use of coloured collodion, which contains free iodine, will produce this acid in the bath; but, if acetate of silver or soda be present, the free nitric acid is converted into free acetic acid, in the manner described at page 21. Where colourless collodion is always used, no nitric acid can be set free.

Want of acetic acid.

The silver bath for *iodized* collodion should always have sufficient *acetic acid* to turn litmus paper to a claret colour; if it does not do this, add a few drops (say one drop to four ounces of bath), and if still insufficient, add a further similar quantity. If, on taking a picture with this bath, the dark shadows remain clear under development, but still want force, add solution of acetate of soda, (see page 21,) one drop to each ounce of bath or thereabouts, allowing time for the acetate of silver to dissolve. If this fails to effect the desired object, the bath is in fault, and had better be replaced by a new one.

Want of acetate of soda.

Old bath.

## FOGGY PICTURES.

An over-exposed picture, as described in the previous chapter, has a *foggy* appearance. When too much light is in the operating room, even though it be admitted through a yellow medium, a clear picture cannot be produced. A candle even, if placed too near the plate during development, will fog the picture. White light also may find its way through cracks and crevices in doors or windows, and should be carefully excluded. The camera and dark slide should also be examined to secure its being impervious to light. The back, containing the sensitive plate, should be carefully covered with a black cloth, during its transit to and fro between the operating room and the camera, more especially when working out of doors in a strong sunlight.

From over-exposure.

From light.

If the bath does not contain some free acid (acetic for iodized collodion and nitric for bromo-iodized collodion), a foggy and dirty picture is

Want of acid in bath.

produced, covered with marks and stains of various kinds. If, when tested with litmus paper, free acid be found to be present, then the fogging may arise from the bath being old and charged with ether and alcohol. In this case pour the bath into a clean jug or bottle, cover lightly with paper so as to exclude dust, but not to prevent evaporation of the ether and spirit; place the vessel in a warm place for several days (say a week), filter, and it will probably be again fit for use; or the evaporation may be expedited by placing the vessel containing the bath in a saucepan of water, kept simmering for an hour or so. There comes, however, a time when baths, like human beings, will stand no more doctoring.

Bath old, charged with ether and alcohol.

Want of acid in developer.

An insufficiency of acid in the *developer* produces a foggy picture. In warm weather more acid is required to retard the development and keep the picture clean, than in cold weather.

From a gutta-percha bath.

The use of a gutta-percha bath is likewise a fruitful source of foggy and dirty pictures, as described at page 23.

From ammoniacal fumes.

The fumes of ammonia in the room, or new paint giving off fumes of turpentine, will effectually prevent a clear picture from being obtained.

From impure nitrate of silver.

Impure nitrate of silver, whether fused or not, is a common source of foggy dirty pictures.

From the Collodion.

It should be borne in mind that when a collo-

dion, such as the one under consideration, is employed, where all the proportions are so nicely balanced and adjusted as to give very quick pictures, it behoves the operator to see that all his other preparations, especially his bath, are of the utmost purity, for it is found that a slow-working and coloured collodion will often give good pictures with a bath that will not do at all for a neutral and quick collodion. If, therefore, the operator is unable to replace his bath, he can colour the collodion, either with tincture of iodine, or some old-coloured collodion; but, of course the sensitiveness will be very much diminished.

## STREAKY WAVY LINES AND MARKS.

From the Collodion not being set.

If lines, having a streaky, wavy appearance, appear at the bottom of the plate, at the corner where the collodion was poured off, then the film has not had sufficient time to set before immersion in the bath. This description of line may be seen after the plate has been removed from the bath, and before exposure in the camera. When the plate has been immersed very quickly, these lines appear over the body of the film. A longer time must be allowed for the collodion to set; in cold weather and with large plates (15 by 12), the writer has had to give as much as two minutes after the plate has ceased to drip (or say three minutes from the commencement).

From the Camera back.

There is another description of wavy marks or stains, which appear under development, and come from the bottom of the plate, appearing somewhat like a curtain. This is a very common failing, and may be remedied by varnishing the dark slide

at the points where the plate comes in contact with it, silver wire corners and all, with shellac varnish (shellac one ounce, spirit of wine one and a half ounce, placed in a warm place to dissolve). As this varnish continually wears off, it will require renewing from time to time, but this even will not be effectual, unless the dark slide be kept clean by wiping out after each time of use, either with a linen cloth kept for this purpose only, or by the free use of blotting paper.

It may be as well in this place to caution the reader against the substitution of sealing-wax varnish for the above; the writer knows two gentlemen who used this, thinking that sealing wax being composed principally of shellac, was therefore as good, but it was found impossible to obtain clean pictures from slides so varnished. This result arose from the colouring matter, vermilion, (bisulphide of mercury,) setting up a decomposition of the nitrate of silver bath.

From the bath.

When wavy lines, like watering, appear on the top of the plate, this arises from a film of dust or other organic matter, perhaps ether, resting on the surface of the bath, which adheres to the top of the film as the plate is brought out, and produces stains. In this case, if the bath be not too old, the *filtering* of the solution cures it,

otherwise, the bath must be put aside for rest and evaporation, as before explained.

Sometimes, from an old or alkaline bath, or one kept in gutta percha, the plate is covered all over with foggy and streaky lines; if a few drops of acid will not remedy this, the bath must be put aside as useless.

Imperfect cleaning of plate.

Smears and smudges are caused by the plate not being properly cleaned (see page 44).

There is a kind of streaky wavy line which appears all over the surface of the film, caused by removing the plate too quickly from the bath. Some collodions require longer immersion than others. The plate should be examined, to see that the greasy looking lines have disappeared, and that the bath solution runs freely over the surface, before it is placed in the dark slide.

# SPOTS.

THESE are the photographer's greatest enemy; even old and experienced hands find it very difficult at times to get rid of them, and the more neutral and sensitive a collodion is, the more readily do spots appear. Again, newly iodized collodion is more troublesome in this respect, than when it has been some time mixed. Spots are of several kinds, and before a remedy can be applied, the operator should be able to discriminate between them. Of several kinds.

The first, the *opaque* kind, often called *comets*, are produced by dust on the surface of the glass plate. The best remedy is to pass a flat camel-hair brush over the surface of the plate to remove the dust before the collodion is poured on; some operators use india-rubber blowers, but the brush answers the purpose better. This brush should be carefully kept clean and dry in a box. Opaque spots.

The most troublesome and annoying spots are the *transparent* ones, caused by dust settling on the film during exposure, and so preventing the Transparent spots.

From the bath.

light acting thereon. They may arise from the bath having particles of dust or other floating matter in it, which can be removed by filtration, or they may come from the operating room being

From the camera.

dusty; but the most prolific source is the camera. If the camera be not kept constantly closed, dust settles and accumulates therein. The act of putting in the dark slide disturbs this, to settle on the wet surface of the film. In the writer's experience this has been by far the most fruitful source of spots. The remedy is carefully to wipe out the inside of the camera with a damp cloth or sponge; and always remember to keep the camera closed, by putting in the ground-glass screen as soon as the dark slide is removed.

From the Collodion.

There is yet another kind of transparent spot, very minute, and distributed pretty evenly over the film. This mostly occurs in newly-iodized collodion, and can generally be rectified by adding some old, coloured collodion, or by adding a small quantity of a bromide, say,—

| | | | |
|---|---|---|---|
| Bromide of ammonia ... | ... | ... | 20 grs. |
| Spirit of wine ... | ... | ... | 1 oz. |

Add from five to ten drops of this solution to each ounce of collodion; or if the bromide be not at hand, add a small quantity of *positive* collodion, which

always contains a bromide, it being a well-known fact that collodion containing bromine is much more easily worked than one containing iodine only; but, unfortunately, there is a considerable loss of sensitiveness as well as of force in the picture, except the bath contains nitric acid, and an iron developer be used first; but with the small quantity given above, this is scarcely perceptible. Sometimes the spots arise from the absence of water from the collodion, and in this case the addition of five or ten drops of water to each ounce of collodion is necessary; but this method is not recommended to be tried until all the others have failed, as it makes the film very tender.

Absence of water in the Collodion.

There is yet another kind of spot, arising from the small particles of undissolved cotton or other matters floating in the collodion. The spots thus produced are readily distinguished from the preceding ones, as they present the appearance of small fibres of cotton, and are generally opaque, caused by a thickening of the film on the spot. Collodion that has been allowed sufficient time to settle in the stock bottle, so that only the clear is poured off for use, never spots from this cause.

From undissolved cotton.

# TENDER AND ROTTEN FILMS.

THIS defect usually arises from the make of the collodion itself, but there are one or two ways by which it may be produced from the treatment it undergoes.

From too quick immersion, and dryness of film.

If the collodionized plate has been immersed in the bath too quickly, the film will be rotten and break up. Again, if kept out too long, the film of iodide of silver is thin and blue, and becomes hard and contracted, so that the bath solution penetrates with difficulty, and splitting occurs.

Edges of plate not ground.

The plates ought to have their edges roughened, so as to give the collodion something to cling to; this, which is done with very little trouble, greatly favours the adhesion of the film, and enables it to stand the subsequent washings.

# PART IV.

# POSITIVE PICTURES ON GLASS.

# POSITIVE PICTURES ON GLASS.

Though the manipulation of the positive process on glass differs but little from the various methods recommended in the foregoing part of this work, and much of what is said there is applicable also to positives, yet the results to be arrived at are so essentially different, that we have to make considerable alteration in our chemical preparations.

Differs little from the negative process.

To obtain a good *negative* we strive to produce as much *density* as is consistent with good half tones, the picture being in the body of the film, knowing that without this, a good printing negative cannot be produced. The *positive* picture, on the contrary, should be a *thin* deposit on the surface only, and to obtain this in a state of whiteness and purity, is the end to be striven for. This is much easier than the negative process, inasmuch as we have only one aim, the production of a good positive, and have not further to consider its printing capabilities; moreover the introduction of a full proportion of bromine into the collodion,

Difference between the negative and positive.

together with nitric acid into the bath, gets rid of a great many of the difficulties that accompany the production of a negative, when collodion containing *iodide only* is used.

# THE COLLODION.

THIS preparation should contain a proper proportion of bromine, as this is found to give a thin surface deposit. A little free iodine is also of service, as it tends to preserve the shadows clear, the colour need not be more than a pale sherry colour. It is sold ready prepared as bromo-iodized collodion for positives. Should contain bromine.

For the method of coating the plate with collodion, and the precautions to be taken, the reader should turn to page 48.

## THE NITRATE OF SILVER BATH.

Strength of bath.

DISSOLVE 120 grains of nitrate of silver in four ounces of distilled water, and add one drop of nitric acid. Some operators think a quicker and better picture is obtained by increasing the strength of the bath to 40 grains of nitrate of silver per ounce.

Similar precautions must be observed in preserving this bath, as are taken for the negative one, though there does not appear to be the same liability to get out of order as is the case with the negative bath. The nitric acid in the bath, and the bromine and free iodine in the collodion, enable the operator to obtain clean pictures, under circumstances in which it would be impossible to procure one by the negative method. The bath also has the property of keeping in good working order a much longer time than the negative bath. Should it at any time give foggy pictures, the addition of a few drops of nitric acid generally

Easier preserved than the negative bath.

Nitric acid required occasionally.

cures it, unless it be charged with organic matter from a gutta-percha bath, or from any other source; for this no reliable remedy can be prescribed.

# DEVELOPMENT.

Practice necessary.

On this part of the process depends much of the beauty of the picture; considerable judgment is required to know how far to push the development and when to stop, and this can only be acquired by practice and experience. As the positive picture, however, is to be viewed only on the surface, this matter is somewhat easier than in the production of a negative. In the composition of the collodion and the bath, the object is as before explained, to obtain a thin deposit of silver only, and in the development, the aim of the operator is to get a clean surface deposit of silver, either dull or metallic as he may prefer.

Kind of deposit required.

Dull or bright deposits, how obtained.

A developer made with, say ten grains of protosulphate of iron and ten drops of glacial acetic acid to one ounce of water, is found to give a dull deposit; but, if two or three drops of *nitric* acid be substituted for the acetic, the deposit is of a bright metallic appearance. If these two acids be used in combination, in some such proportions as

are given in the formula below, the operator is furnished with a developer that will accomplish all that he could wish.

Developer for positive pictures. Developer.

| | |
|---|---|
| Protosulphate of iron... ... | ½ ounce |
| Glacial acetic acid ... ... | ¼ ,, |
| (or Beaufoy's acetic acid) | 1 ,, |
| Nitric acid ... ... ... | 4 drops |
| Distilled water ... ... | 1 pint. |

Half-an-ounce of spirit of wine added to the above makes it flow more easily over the surface of the film. The protosulphate of iron may be increased to as much as two ounces, but the development with it is so rapid that it is difficult to get the fluid over the plate without leaving marks and stains, so that only experienced hands can use the strong solutions. As a rule, the stronger solutions enable one to do with a less exposure in the camera, and are therefore useful in dull weather; they likewise throw down the silver in a whiter condition than the weak solutions. Strength of developer.

With this developer, varied as above indicated, the kind of deposit is so entirely under control, that no further formula need be given; it being no part of the writer's plan to do more than state the methods and expedients which, in his experience, Should be varied as required.

have been found to answer best. To do more would not only embarrass the beginner, but unnecessarily enlarge this little work.

The method of development differs from the negative mode. The deposit being a very thin one, is not readily seen, unless it be looked through with a light behind it; the development, too, requires to be stopped at the proper time, which is the moment the details of the dark parts appear. If allowed to go on too long, the shadows get clouded, and a flat poor picture is the result; a supply of water must, therefore, be ready at hand to wash the developer off the instant the picture is sufficiently out. Nice attention to this matter will secure beautiful clear shadows.

To be stopped at the proper time.

The plan that answers best is holding the plate at one corner, by the finger and thumb of the left hand (the plates being small there is no difficulty in this), the developing fluid, in a glass measure held in the right hand, is poured on and off several times, until a sufficient effect has been produced. On holding up the plate to the light, the progress of the development is easily seen and stopped at the right moment. If the correct time of exposure in the camera has been observed, the picture will gradually appear, the high lights first, and then the details of the darker parts.

Method of developing.

The plate has now to be washed, to get rid of

To be washed.

the developing solution, or the application of the cyanide of potassium will decompose the proto-sulphate of iron, and produce a blue deposit of ferocyanuret of iron, or prussian blue.

# FIXING.

Strength of solution.

The positive picture is best fixed by a solution of cyanide of potassium, as this preserves the silver deposit in a whiter condition than solution of hypo-sulphite of soda; but care must be taken that the solution is not used too strong, or the half tones will be destroyed. Half-an-ounce of cyanide dissolved in a pint of water does very well. When the creamy appearance of iodide of silver, which the plate obtains in the nitrate of silver bath, has disappeared, the plate must be carefully washed in the same manner as the negative, in order to free it from all trace of the cyanide of potassium, which, if allowed to remain, would gradually destroy the picture. The plate is now set on edge to drain, and may be either allowed to dry spontaneously, or held before a fire.

To be well washed.

# VARNISHING.

WHEN the picture is to be coloured, a somewhat sticky varnish is to be used, to enable the colours to adhere; this kind is to be obtained of the dealers; but where colour is not to be employed, the hard varnish used for negatives is the best preservative. These varnishes require the plate to be warmed, and are applied in the same way as to the negative. The picture further requires to be backed up with black, either black varnish, paper, cloth, or velvet. For colouring.

## SUNDRY MATTERS.

Cleaning plate.

FOR the best means of *cleaning* the plate, the reader is referred to the directions given in the case of the negative. Good crown glass may be

Kind of glass.

substituted for the patent plate, and there is no occasion to grind the edges, for where iron developers are used, the film is much more adhesive

Coating the plate, and exposure.

than with pyrogallic acid. For *coating* the plate, and *exposure* in the camera, nothing further need be added to the chapters under these heads given in the former part of this work.

Failures.

The various sources of *failure* too, though not so frequent in the positive as in the negative process, for reasons before stated, are still in the main the same, and, having been previously treated of, the reader can turn to the several chapters.

# PART V.

# OF THE PRINTING.

# PRINTING.

To obtain a good print from the negative was at one time thought to be an easy task; but if one may judge from the continual complaints and troubles about getting good proofs, it would appear to be the most difficult part of the whole process.

Though a novice, however, may still have some difficulty in obtaining a good print, which the knowledge procured by practice only can get over, those who have had much experience and print largely, are enabled, with ordinary care, to obtain a good and uniform colour, together with that most essential desideratum, permanence. These important points are secured by the use of chloride of gold for toning, and of clean and neutral solutions of hyposulphite soda for fixing. The old method of getting good tones, by use of old hypo-baths and other means of toning with sulphuret of silver, are now entirely given up, as it was found prints so toned were very far from permanent.

Uniform colour with permanence, how secured

Old hypo exploded.

To albumenize paper.

It may be as well to describe the method of *albumenizing* paper, though few photographers care to take the trouble to prepare for themselves, as it can be purchased good and cheap.

| | | | |
|---|---|---|---|
| Take of albumen | ... | ... | 15 ounces |
| Water | ... | ... | 5 ,, |
| Chloride of ammonium | | | 120 grains. |

Dissolve the chloride of ammonium in the water, and add it to the albumen, in a vessel sufficiently large (a clean basin will do) to hold the froth as it arises, then with a silver fork, a bundle of split quills, or an egg whisk, beat the whole up to a froth, and put it away in a tall vessel to subside.

Strength of the chloride may be varied.

The above quantity of chloride of ammonium is the proportion recommended for general use, but the printer will find it desirable to have papers salted of different strengths, that he may vary the paper according to the power of the negative.

Experiments with papers salted of various strengths.

The writer instituted a set of experiments on this point, viz., the effects of the strength of the salt in the paper; and six samples of the following strengths were prepared:—half a grain, one grain, two grains, four grains, six grains, and ten grains per ounce. The very low salted papers, the half grain and one grain, took a long time to print, and were of a foxy red, but, when toned with

gold, gave a fine purple tint, of great force, much *too* forcible for an average negative, but very valuable to give force to prints from a feeble negative; the four and six grain papers produced the best effects, when used with an average negative, printing red and toning to a fine deep purple in the gold bath; but for intense negatives, the ten-grain paper was found to be the best. The sensitizing bath was of the usual strength of 60 grains to the ounce, in all these experiments. Having provided the solution of albumen and salt, pour into a porcelain tray a sufficient quantity of the clear liquid to cover the bottom of the tray to a depth of at least a quarter of an inch, carefully removing all froth and air bubbles from the surface, by means of a piece of clean glass or paper.

How to float the paper.

The paper to be albumenized is held at the two ends, by the fingers and thumbs of both hands; curve the paper by bringing the two hands together, letting the curve hang downwards, lay the point of the curve furthest from you in contact with the albumen in the tray, and then quickly but steadily place the whole of the bottom of the curve on the surface of the albumen; the two sides are then to be gradually but quickly lowered, when the whole will float smoothly on the surface of the albumen. If this has been

properly performed, the back of the paper will not be wetted, and there will be no air bubbles under the paper. If any air bubbles are present, the paper must be gently lifted at the corner, and the bubble removed by blowing with india-rubber blowers, and then replaced on the albumen. A little practice will soon enable the operator to lay the paper down free from air bubbles.

Air bubbles must be removed.

The albumen works easier and better when it has stood for several days after beating. If a very high glaze be desired, less water must be used, or it may be entirely omitted; but, when so thick, the manipulation is very difficult.

Highly albumenized.

The paper, after it has remained on the albumen for a minute or so, is lifted at one of its corners by a pair of horn forceps, sold for the purpose, and then hung up to dry, fastening it up either with varnished pins (black mourning pins), or what is better, American clips.

Time to remain.

Hanging to dry.

The more rapid the drying, the higher will be the glaze, and where highly albumenized papers are required, they must be hung up in a warm atmosphere to dry quickly, or much of the albumen will drain off before they are dry.

Rapid drying desirable.

French and German papers, being sized with starch, are best fitted for albumenizing.

Kind of paper to be used.

## SENSITIZING THE PAPER.

Pour a sufficient quantity of solution of nitrate of silver, of the strength of 60 grains to the ounce, into a flat tray, either of glass or porcelain, to the depth of about a quarter of an inch, and float, in the manner above described, a piece of paper, with the albumenized side downwards, on the surface of this bath for four minutes, and hang up to dry, using none but varnished pins or American clips. Strength of bath.

Considerable difficulty is experienced in keeping this bath clean and in good working order, from the dark colour which the albumen soon imparts to it, and which increases by use. The surface of the bath also films over and produces wavy stains, like watering, on the surface of the albumen.

Many plans have been recommended for getting rid of the colour, the most certain of which is the use of kaolin; a small quantity (say a quarter of an ounce) being shaken up with a pint of coloured To remove colour from the bath.

bath, and allowed to stand an hour or so; the liquid is then filtered, and if sufficient kaolin has been used, it will be colourless, though a little colour is not of much importance. Sometimes the kaolin contains carbonate of lime, which will decompose the nitrate of silver, causing waste, and occasionally rendering the bath alkaline, in which state it will dissolve the albumen. Kaolin may be freed from lime by adding dilute acetic acid, until effervescence ceases, being then placed in a filter, water is passed through to remove the acid, and it is afterwards dried for use.

To remove lime from kaolin.

A small quantity of citric acid added to the bath has a tendency to keep it clean, and seems to obviate, though it does not entirely prevent, the rapid colouring; a certain vigour appears also to be imparted, by its use, to the print. The quantity should be only enough to make the bath slightly acid (say one grain to two ounces of bath).

Should be slightly acid.

The *film* that forms on the surface of the bath may be removed by passing the edge of a piece of bibulous paper over the surface, or, what is better, by filtration. It will be found convenient to keep a funnel and filter for this purpose solely, the filter will do for a long time, so as to avoid the waste of silver consequent upon using fresh paper every time. If the bath, after use, be poured into a vessel containing a little kaolin, also reserved for

To clean the surface of bath.

To filter the bath.

this purpose only, and after standing some little time, be filtered into the stock bottle, a supply of clean bath will always be ready. The evaporation going on during these operations usually keeps the bath up to the required standard of 60 grains to the ounce.

Sensitized paper will not keep.

The paper should only be sensitized as it is wanted for use, for it will not keep. If, by chance or a dull day, any be left over, the best way of preservation is to screw it up tight in a pressure frame, and keep in a dry place ; but even if by this, or other means, the paper be prevented from darkening, it will still be found difficult to tone in the gold bath.

# PRINTING.

Position of negative and paper.

PLACE the negative, collodion side upwards, on the glass of the opened pressure frame, and a piece of the above sensitized paper, sensitive side downwards upon it, replace the back board, and then, by means of the screws, bring the paper into close

Exposure.

contact with the negative. It must now be carried into the light and exposed a sufficient time, either to the direct light of the sun, or a diffused light. The paper gradually darkens under the influence of light, and the progress may be examined from time to time by unscrewing one-half of the back

Must be over-printed.

board. The print must not be removed from the frame until it is *considerably darker* than it is required to remain, for the after process of toning and fixing much reduces the strength of the picture.

A pad should be used.

A very useful addition to the pressure frame is a piece of thick soft felt, or ironing blanket doubled, to place upon the back of the paper before putting

in the back board; this provides a soft and even pressure, and lessens the risk of breaking the negative.

Printing in sunshine or shade.

Much difference of opinion prevails respecting the advantage or disadvantage of printing in direct sunlight or in shade. Where the negative is weak and prints rapidly, direct sunlight presents a great difficulty in the fact of such negatives being so easily over-printed, and therefore many copies spoiled. This is remedied in a great measure by slow printing in the shade, which gives time for the operation to be more closely watched and stopped at the proper time; it is also fancied that a more forcible picture is obtained, but whether this be so or no, one thing is certain, that a shade-printed proof loses much more in the fixing than a sun-printed one, and therefore requires to be more over-printed. This would point to the conclusion that sun-printed pictures are likely to be more permanent than the others. However this may be, the operator will find it necessary to adopt sometimes one method, sometimes the other, according to the strength or weakness of his negative, it being almost impossible to get out the details of a very strong negative, without printing in the sun. In this, as in all the other operations of photography, experience will be the best guide.

## WASHING, TONING, AND FIXING.

To wash out the free nitrate of silver.

THE prints have first to be washed, to get rid of the free nitrate of silver. For this purpose they should be placed in a tray of clean water, which will require changing some three or four times; or a stream of water may be made to flow through them from a tap, until the water ceases to have a cloudy appearance. About half an hour generally suffices to effect this, and they are then ready for the toning bath.

Toning bath.

Toning bath :—

| | |
|---|---|
| Acetate of soda... ... | ... 1 ounce |
| Water ... ... ... | ... 1 quart |
| Solution of chloride of gold | ... 1 drachm, or as much as may be sufficient. |

Chloride of gold.

The chloride of gold should be kept in solution of the strength of one grain to the drachm. If this solution be *acid*, a little carbonate of soda

must be added, until it ceases to redden litmus paper. It will be found better to use the chloride of gold and sodium, or non-deliquescent chloride of gold, as it is sometimes called: but even this occasionally is acid, and requires a little carbonate of soda to correct it. The chloride of gold being so deliquescent is very troublesome and wasteful.

Black margins to be cut off.

Before commencing operations, the pictures should have the whole of the black outside margins cut off, for these, being generally deeply bronzed, take up and waste a large quantity of the gold.

Acetate, phosphate, and carbonate of soda, their difference.

Preference is given to the acetate of soda over the carbonate and phosphate, from the fact of its shewing less disposition to *blister* the highly albumenized papers; moreover, if excess of gold be employed, and the solution kept for further use, the gold is not so readily precipitated and wasted, as is the case with the alkaline solution.

Action of acetate of soda.

The use of the acetate of soda being only to facilitate the deposit of the gold, in somewhat the same manner as a flux is used to promote the fusion of metals, will last for a considerable time, or until it gets dirty from accumulation of oxide or blackened chloride of silver, removed by the action of the gold: for it should be understood that the gold is not, as was once supposed to be the case, deposited on the silver

The gold substituted for the silver.

of the picture, but it takes the place of the silver, by substitution.

The due comprehension of this fact will better enable the operator to secure the colour he wishes, for it may be compared to the artist's mixing two colours together; if, for instance, the print, when removed from the frame, be of a red appearance, then the change made by the gold will simply be the addition of a deep purple colour, with this modification, that every addition of purple removes an equivalent portion of red. If, on the other hand, the print is of a black or grey tone, as is the case with strongly salted papers, then the result of the substitution of the purple of the gold will be a somewhat dull picture, of a black or greyish look. It is found, in practice, that the red colours will take more gold and have much greater force than the black printed ones, these latter require to be carefully watched and removed from the toning bath as soon as they have got sufficient gold, or they will get over-toned, and have a flat, weak look, anything but desirable. Of course there is the happy medium between the two extremes.

Varieties of colour, how obtained.

The quantity of gold requisite to be placed in the bath must be regulated by the number and size of the pictures to be toned, and the colour required. It has been stated that one grain of

Considerations for the quantity of gold requisite.

gold will suffice to tone a sheet of paper 22 × 18, but this estimate must be modified by several considerations; in the first place, by the colour of the picture before it enters the toning bath, as previously explained, the red tints taking more gold than the black ones; in the second place, the quantity and intensity of the printed matter on the sheet, it being obvious that where there is much white or slightly printed surface, not so much gold is required as where the conditions are the reverse; in the third place, the quantity of gold depends upon the colour required; if the medium of these three conditions be taken, *i.e.*, if the print, to begin with, is of a brown colour, the paper, say, half covered with printed surface, and the colour required a rich brown, then one grain of gold would no doubt suffice; but if different conditions obtain, then two grains may be no more than enough to produce the purple-black tint.

Precautions for even toning.

The prints, being immersed in the bath, must be moved about to prevent their adhering together; care also should be taken that no air bubbles be present, or corresponding spots will be found in the finished proof. The pictures must be taken out and examined from time to time, to see whether they are sufficiently toned, and it is precisely in this that the judgment and

experience of the operator are wanted, for the action of the hyposulphite bath so modifies and reduces the colour, that nothing but experience can enable him to judge of the right time for removal. If the print be removed when it has just acquired the purple tint, the hyposulphite bath will change it to a rich brown, but if the purple tint be wanted, then the toning must be prolonged until the print is of a bluish-black colour.

When to be removed.

The time necessary for this operation depends upon the strength of the gold bath and the temperature; if, for instance, having pictures equivalent to, say, six sheets of paper (22×18), you put at once into the bath the quantity judged necessary for the whole of them, say nine grains, then the first prints will be very rapidly toned, perhaps in three or four minutes, or less, if the temperature be at about 50°, while the later ones, being in a weak solution, would probably require half an hour. Supposing these six sheets of paper cut into twenty-four prints of 9×11 each, no more than six of these can be safely toned at a time; so that, as a general rule, it is better to put the required quantity of gold in for each lot, a better and more uniform effect being thereby produced. With the strong solutions, unless great care be taken in the

Not too many at once.

removal of the first batch immediately they are toned, they get spoiled from being over-toned, and acquire the cold-grey, feeble look, well known to photographers: so that in no part of the photographic art is more care and nice discrimination required than in this of toning, but with practice and careful observation, the knowledge is not difficult to acquire.

Grey tint from over-toning.

Much disappointment is occasioned by the attempt to examine the toning by yellow light, or, what is the same thing, the light of a candle or gas, it being impossible to judge of the tone under a coloured light. The toning may be done in a room *feebly* illumined by white light, or in a low evening light, or, what is better, perhaps, in a tray in the yellow lighted room, so that the prints may be separately carried to the doorway for examination under white light; this short exposure will not injure them.

The toning cannot be judged of under coloured light.

The pictures being, in the judgment of the operator, sufficiently toned, are to be removed to the fixing bath, which is made thus:—

Fixing.

| | | | |
|---|---|---|---|
| Hyposulphite of soda | ... | | 4 ounces |
| Water | ... | ... | 1 pint. |

A piece of chalk should be placed in the bath to keep it free from acidity. If much printing is going on, this bath ought to be made fresh every

Bath to be newly made.

day, or the prints will be liable to get sulphuretted, and to fade; but where there is but occasional printing, and only of a few pictures at a time, the bath can be used frequently, but should be rejected as soon as it becomes dirty.

Loss of strength in fixing.

The novice will be surprised to find how much his pictures lose in strength in the fixing, and how the colour is altered; he must recollect and be prepared for this during the printing and toning.

Time required.

The action of the bath is pretty quick, the unchanged chloride of silver being generally dissolved out in five or six minutes, unless the paper be very thick, or too many pictures put in the bath at one time; the number ought not to exceed some six or eight, unless a large tray, with a corresponding quantity of solution, be used. The pictures require to be kept in motion, to prevent their adhering together; this is conveniently done by shaking the tray. Air bubbles, too, must, as in the toning, be carefully looked after, or spots will be produced.

Washing.

There now only remains the removal of the hyposulphite of soda and silver, and perhaps this is the most troublesome and uncertain part of the whole process; troublesome, from the necessity of getting rid of all trace of the hyposulphites, which can only be done by soaking in clean water, with frequent change; uncertain, from the fact of there

being no reliable test by which to ascertain that these chemicals have been entirely removed. The hyposulphite of silver, being intensely sweet, may be detected by the tongue, even when a very minute amount only is present; but the quantity necessary to cause the print to fade is so infinitesimal, that this is a test of little practical use. The only secure plan is, so thoroughly and carefully to wash the print in abundance of clean water, that it would be impossible for any soluble matter to remain. The way to do this effectually, with the least expenditure of labour, in the shortest time, is the problem to be solved. Many plans have been suggested, which it would be both tedious and unprofitable to enter into the consideration of here. It will suffice if the author describes the mode which he has practically found to be the best, after eight years' experience.

Method of Washing.

The print, being removed from the hypo-bath, is held by two corners, between the fingers and thumbs of both hands, the print hanging downwards, and is then passed under a stream of water issuing from a tap, and slowly moved to and fro through the centre of the stream; the upper edge of the print cuts the stream in two, a portion flowing over each side, so as to remove a very large quantity of the adhering hypo-bath from the surface. A tray of clean water being provided,

To be moved about in the tray.

the prints are placed therein, care being taken not to have too many at a time, or they will stick together, so that the water cannot penetrate them. It will be necessary to move them about to obviate this. After soaking for some ten or fifteen minutes, or longer, the whole of the prints should be taken out in a body, placed on a glass plate, and set up on edge to drain; the prints, being wet, will readily adhere, if there be not too many on one plate. The washing vessel having been rinsed out, and supplied with fresh water, the prints, after being left for about five minutes to drain, are to be separated one by one, and placed in the fresh water. If this process be carefully repeated some six or eight times, there can be no doubt that the removal of the hyposulphites is as perfect as it is possible to be, and this may be effected in two or three hours.

Drained.

Two or three hours sufficient by this plan.

Washing in a stream of water.

A stream of running water is a very favourite mode of washing; but unless the time of washing be greatly prolonged, it cannot be so perfect as the one above described, for to those not conversant with the fact, it is surprising how long it takes to entirely change the water by this means. During the writing of these lines, an experiment was instituted, to prove how long a time was occupied, by this method, in changing the water in a tray. A tray was filled with twelve pints of

Experiment.

water, to which two ounces of ink had been added, and well mixed; water from a tap was then allowed to flow into it, through an india-rubber tube, at the rate of three pints a minute; not until three and a half hours had elapsed, and nearly eighty gallons of water used, was the colour of the ink entirely got rid of; and this, be it remembered, was without any prints to impede the flow of the water. There can be little doubt, therefore, that if the tray had been charged with a lot of prints, the water would not have been fully changed in three or four times the period, and unless the prints were moved, the probability is that the centre would scarcely be touched. This shows how difficult it is, by this contrivance, to secure an effectual cleansing of the print.

Printing on plain paper.

The method of printing on plain paper, and the after-treatment thereof, does not differ in any way from the foregoing, it being necessary only to leave out the albumen, in the first preparation ot the paper.

## FAILURES IN PRINTS.

A mottled appearance.

A *mottled* appearance of the print, having some portions dark and others light, shading off into each other, is due either to the weakness of the silver bath, or more frequently to there not being enough bath to float the paper properly, or from insufficient time being allowed for the paper to float on the sensitizing bath.

Spots from air bubbles.

*White spots*, with sharp defined edges, are due to air bubbles on the surface of the bath, preventing the action of the nitrate of silver on the paper.

Weak prints.

*Weak prints* may arise from various causes, the first of which is a weak negative. The only remedy in this case is to use a low salted paper, as described at page 88; but, even then, the result will not be so good as from a strong negative, though it will enable the operator to do much to remedy the original defect. Too weak a silver bath will produce nothing but weak prints. With papers too highly salted, no forcible prints

can be obtained. Over-toning, as previously described, produces a weak grey picture (see page 101).

Spots in the body of the paper.

A dark mottled appearance in the *body* of the paper arises from insufficient fixing, the hypo-sulphite bath not having dissolved out the chloride of silver, either from being too weak, or from the prints not having been long enough immersed; or it may arise from the pictures adhering together, and so preventing the action of the fixing bath.

Yellow tones.

The *yellow tone* that prints often acquire, is sometimes due to acidity, either of the toning or fixing baths, or the latter may have been too long used, so as to sulphuret the print. Too long an immersion in the fixing bath will also impart a yellow, faded look to the pictures.

Marbled on surface.

A *marble* appearance on the print, arises from floating matter, or a scum on the surface of the nitrate of silver bath, which must be removed, either by filtration, or by passing the edge of a piece of paper over the top of the solution.

Stains at the corners.

*Dark brown stains* at the corners of the pictures, are produced by the fingers, contaminated with hypo and other matters, being used in removing the prints from the toning bath, or from the tray in which the nitrate silver has been washed out.

Albumen dissolved.

Occasionally, the albumen gets dissolved off, and a white deposit formed in the silver bath;

the first generally arises from alkalinity, and is remedied by the addition of a small quantity of acetic acid; the latter from the chloride in the paper being in too great a proportion to the nitrate of silver in the bath; the remedy is to strengthen the bath by adding nitrate of silver.

Difficulty of toning.

When the pictures do not tone readily in the gold bath, the failing generally arises from the paper being kept too long after sensitizing, or, if the printing be done in cold weather, from the temperature being too low. Paper that has been sensitized more than twenty-four hours, is always difficult to tone, the difficulty increasing as the time of keeping extends. A trace of hyposulphite of soda in the gold bath, will likewise greatly retard the toning.

Mounting.

A solution of gelatine, or good Scotch glue, is the best article to mount the print with; the strength should be, say, twenty grains to the ounce of water, warmed until dissolved, and applied with a stiff hog's-hair brush.

# PART VI.

# INSTANTANEOUS PICTURES.

## INSTANTANEOUS PICTURES.

Not much need be said under this head, for, in experienced hands, there is nothing like the difficulty that is generally supposed. The great secret consists mainly in the proper selection of the object, at a time when it is well illumined, taking care that no very near objects be included in the picture, for, the more distant the objects, the shorter will be the focus, and, consequently, the more energetic and rapid the action of the light. Coast scenes under a brilliant sun are so luminous (both the sea and sky reflecting light), that the great difficulty here is, with a short focus, quick acting lens, to open and close the lens with sufficient rapidity.

Careful selection of the object necessary.

The new double-combination stereoscopic lenses of short focus, made by Dallmeyer and others, are, perhaps, the best adapted to this kind of work, though they, like all double-combination lenses, produce a central spot of light in the picture, when they are turned in the direction of the sun. The operator should, therefore, provide

Lenses.

himself, in addition, with a pair of single landscape lenses, say, of four and a half to five inches focus; these, with a stop of half an inch diameter, answer very well, though, perhaps, not quite so quick as the former ones; yet the difference in time is not very great, and these can be used when the others cannot. A small triplet lens of seven inches focus, made by Dallmeyer, is also capable of taking instantaneous views, when the whole aperture is used.* Almost all good portrait lenses, if used with central stops of proper diameter, will produce this class of picture, provided the objects be not too near; say, a five-eighth stop for a quarter plate lens, and proportionate sizes for larger ones; but the great drawback to the use of this kind of lens, is the central light spot they so frequently give.

To open and close the lens rapidly.

A method of rapidly opening and closing the lens must be provided, for which purpose there is nothing better than the shutter by Dallmeyer, which accomplishes all that is requisite, giving the longest exposure to the foreground, and while contrived to open and close rapidly, can also be used for lengthened exposures when necessary.

In the absence of such a contrivance as this

* There have been recently published some very good instantaneous sea views, taken by Mr. Wilson, with such a lens, on plates $7\frac{1}{2} \times 4\frac{1}{2}$.

the cap of the lens can be used, though this requires great care and some practice. A thick velvet curtain, or any other dark material, before the lens, may also be made, with proper precautions, to answer fairly.

Careful selection necessary.

Instantaneous views require careful selection, and should have no very near objects, especially moving ones, in the immediate foreground; due care also should be exercised in selecting a time when the objects, especially those nearest to the operator, are not in *rapid* motion. In all moving street views, one point of time will be better adapted than others, to secure a good picture; the experienced operator knows this, and carefully watches for the precise moment to uncover his lens.

Experiments with Collodion.

So much difference of opinion prevails respecting the advantage or disadvantage of adding bromide to the collodion to increase its sensitiveness, that it will be desirable to go thoroughly into the matter. At a recent meeting of the Photographic Society, a paper was read by Mr. England, advocating a very large dose of bromide for instantaneous pictures; several other first-class operators in this attractive department have likewise stated they employed bromine in their collodion. This alleged fact of bromine being an *accelerator*, was quite contrary to my own pre-

vious experience, for, in all experiments with this material, I found that it not only retarded the action, but produced a thin weak negative. But, considering the known ability of these gentlemen, and the high-class works produced by them, it appeared worth while to go over the ground once more, to endeavour to find, if possible, where the discrepancy on such a matter of fact as this could possibly arise.

Five samples of collodion were prepared as follows:—

The Collodion.

No. 1, Iodized Collodion, containing 4 grs. of iodide to the oz.
No. 2, the same Iodized Collodion, with ½ gr. of bromide added
No. 3, ditto ditto „ 1 „ ditto
No. 4, ditto ditto „ 2 „ ditto
No. 5, ditto ditto „ 4 „ ditto

The baths.

Three nitrate of silver baths were also prepared, of the strength of 30 grains to the ounce.

No. 1. This bath was made according to the formula at page 22, with acetate of soda, and acetic acid.

No. 2. To this bath was added a quarter of a drop of nitric acid to each ounce.

No. 3. This was left neutral, or nearly so, having a very minute proportion of acetic acid to prevent fogging.

The developer was made with Developer.

| | |
|---|---|
| Protosulphate of iron ... | 10 grains |
| Glacial acetic acid ... ... | 6 drops |
| Water ... ... ... | 1 ounce. |

Two negatives were taken with each sample of collodion, one exposed two seconds, and the other four seconds, in the three baths in succession, being thirty negatives in all. A landscape lens with a small stop was used, in order to secure complete accuracy and uniformity in time of exposure, which it would have been difficult to obtain with so many negatives, had a shorter exposure been tried.

Without wearying the reader with a detailed account of all the negatives, it will suffice briefly to state the results that came out. The results.

First, as to the baths. With the ordinary iodized collodion No. 1, the bath No. 1, with acetate of soda and acetic acid, was unmistakeably the quickest of the three, the nitric acid bath, No. 2, being very slow; this, it will be remembered, is the precise result of the experiments detailed at page 19, except that a bath with nitric acid was not then tried. But with the collodions containing bromide, the No. 2 bath with nitric acid proved to be much quicker than the other two baths, their slowness as compared with the The baths.

Sensitiveness not increased by large doses of bromide.

nitric acid bath increasing as the proportion of bromide in the collodion increased. No increase of sensitiveness was gained by the large doses of bromide; on the contrary, the collodion No. 5, with four grains of bromide per ounce, worked much slower than either of the other samples. The proportion of one grain of bromide to four grains of iodide, gave the best results, larger doses of bromide imparted a wavy appearance to the film that quite spoiled the picture, and no increase of sensitiveness was obtained.

Bath with nitric acid proved the best.

On comparing the negative taken with the No. 1, on iodized collodion, in the bath No. 1, with the negative taken with bromo-iodized collodion, in the nitric acid bath, the latter was markedly the better. The first was a very intense negative, with strong contrasts of light and shadow, and would have printed hard; the latter was a soft, though a sufficiently forcible negative, giving full details in the shadows, and hardly wanted further development; but, with *instantaneous* pictures, the development will have to be continued by using a weak solution of pyrogallic acid, with a little silver added, say

| | |
|---|---|
| Pyrogallic acid... ... | ... 1 grain |
| Glacial acetic acid ... | ... 6 drops |
| Water ... ... ... | ... 1 ounce. |

Solution of nitrate of silver (strength, 50 grains to the ounce), five or six drops, or more if great intensity be required.

The iron developer must be previously washed off.

Final results.

These experiments, which have since been fully confirmed in practice, clearly demonstrate that for instantaneous pictures, it is necessary not only to use bromide in the collodion, but a small proportion of nitric acid in the bath; these, with an iron developer as strong as the operator can use, as described at page 30, strengthening by the use of the pyrogallic developer, is all that is requisite in the way of chemicals. But it must be borne in mind, that everything must be of the highest degree of purity, and prepared with the utmost care.

Failures numerous.

In this difficult department of instantaneous photography, the novice must be content with only an occasional success; for with experienced hands there is a large proportion of failures, the picture requiring to be taken as soon as possible after the removal of the plate from the bath, it being then in its most sensitive condition. If, from causes frequently in operation, such as a cloud passing over the sun, or having to wait until the objects are in a good position, the plate should have its silver bath drained away, the

sensitiveness is much impaired, and consequently fails to secure a good negative.

Bromo-iodized Collodion tried for portraiture.

The same bromo-iodized collodion, with the nitric acid bath, was also tried for portraiture, and found to effect a considerable saving in the time of exposure; but the use of the two developers, and the long time occupied in the development, is somewhat against it. Where, however, a short sitting is desired, the extra trouble must be put up with; against this must be placed the ease and cleanliness of working with a collodion containing bromide.

# INDEX.

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